

Notice of Allowability

Application No.

10/019,975

Examiner

Mark Ruthkosky

Applicant(s)

HATOH ET AL.

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 6/7/2004.
2. ☒ The allowed claim(s) is/are 1, 2 and 4.
3. ☒ The drawings filed on 23 October 2001 are accepted by the Examiner.
4. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) ☒ All b) ☐ Some* c) ☐ None of the:
 1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☒ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
 6. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
 - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____
7. ☐ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____

Mark Ruthkosky
9/1/04

DETAILED ACTION

Claim Rejections - 35 USC § 112

The rejection of claims 3 and 4 under 35 U.S.C. 112, second paragraph, has been overcome by the applicant's amendment.

Claim Rejections - 35 USC § 103

The rejection of claims 1, 2 and 5 under 35 U.S.C. 103(a) as being as being unpatentable over Hiroshi et al. (JP 8-111,230) has been overcome by the applicant's amendment.

Allowable Subject Matter

Claims 1, 2 and 4 are allowed.

The following is an examiner's statement of reasons for allowance:

The instant claims are to a method of operating a polymer electrolyte fuel cell comprising a pair of electrodes sandwiching a polymer electrolyte membrane, a conductive separator, a means for supplying and discharging a fuel gas and an oxidizing gas to and from said electrodes, a moisturizing means for said fuel gas and/or said oxidizing gas, and a means for circulating cooling water in a plane direction parallel to said electrodes, said method comprising the steps of: measuring at least one physical quantity selected from the group consisting of a gas flow rate of said fuel gas, a gas flow rate of said oxidizing gas, a saturated steam pressure in said fuel gas, a steam pressure in said fuel gas, a saturated steam pressure in said oxidizing gas, a steam pressure in said oxidizing gas, a temperature of said electrode and an output current value;

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regulating at least one physical quantity selected from the group consisting of a flow direction of said cooling water, a temperature of said cooling water, a flow amount of said cooling water, a supply amount of said fuel gas, a supply amount of said oxidizing gas, a moisture amount in said fuel gas, a moisture amount in said oxidizing gas, a temperature of said electrode, a temperature distribution of said electrode and an output current value; and thereby maintaining a property value Y calculated by the formula (1):

$$Y = V^n \times (\Delta P)^n \quad (1)$$

wherein V indicates a flow rate of said fuel gas or said oxidizing gas, AP is the difference between a saturated steam pressure and a steam pressure in said fuel gas or said oxidizing gas and m and n are predetermined values, to be not less than a first predetermined value and not more than a second predetermined value; wherein a temperature of an electrode starting point is made lower than a temperature of an electrode outlet point in said electrodes, said electrode starting point being a portion into which said fuel gas or said oxidizing gas is introduced and said electrode outlet point being a portion from which said fuel gas-or-said oxidizing gas is discharged and wherein a temperature of said electrode from said electrode starting point to said electrode outlet point is changed against a distance from said electrode starting point to said electrode outlet point according to a curve opening downwards.

The prior art does not teach a method for operating a polymer electrolyte fuel cell comprising these elements and steps. The most pertinent prior art has been presented. Hiroshi et al. (JP 8-111,230) teaches a fuel cell including a pair of electrodes a polymer electrolyte membrane, a conductive separator, a fuel and oxidizing gas supply and a means for circulating coolant. A method of operating the fuel cell is taught wherein the optimal value of the

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temperature of the upper section inside the cell at which the output is the greatest and the optimal value of the difference between the temperature in the upper section inside the cell and the temperature in the lower section inside the cell, are determined from the current density, reactant gas pressure, the inlet air dew point, the air utilization ratio, and the rate of discharge of water produced, by adjusting the temperature and flow of the coolant, such that the optimal value of the temperature in the upper section, and the optimal value of the difference between the temperature in the upper section and the lower section can be controlled. Since a balance is always reached between the water produced and discharged in any section within the cell, the reference presents conditions of measuring and regulating physical quantities disclosed in the claims (pg. 4, lines 3-9.) The reference further teaches that the temperature distribution within the cell is formed in such a manner that it increases progressively in the direction in which the reaction gas flows (page 5, left column, lines 14-17.) This would include the electrode length from the inlet to the outlet.

Claim 1 further states that a property value, Y, is maintained according to the formula (1)

$$Y = V^n \times (\Delta P)^n$$

wherein V indicates a flow rate in (m/sec) of the fuel or oxidant gas; ΔP is the difference between a saturated stream pressure and a stream pressure in the fuel or oxidant gas in (kgf/m^2), and $1 < m < 2$ and $1 < n < 2$ are satisfied to meet the values of 2×10^3 to 1.4×10^8 . The reference does not teach this specific relationship, however, it is noted that when the values of m and n are equal to one and the current density is 0.3 A, the value of Y is in the range of 2,000 to 30,000 and that when the value of Y is greater than 30,000, the cell is overly dried. Further, the reference does not teach that the gas outlets are made substantially open to an ordinary pressure.

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The vapor pressure distribution of the reaction gas is noted to be such that the pressure increases the closer it gets to the gas flow outlet port side and it prevents the discharge of water. The reference does not teach altering the temperature of the electrode starting point through the exit point such that the change in temperature along the length of the electrode is reflected in a curve opening downwards or that the temperature increases to a point and then decreases along the length of the electrode in order to form a curve opening downwards.

As the prior art does not teach a method as claimed, including altering the temperature of the electrode starting point through the exit point such that the change in temperature along the length of the electrode is reflected in a curve opening downwards or that the temperature increases to a point and then decreases along the length of the electrode in order to form a curve opening downwards, the claims are allowed.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Examiner Correspondence

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-1193. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mark Ruthkosky whose telephone number is 703-305-0587. The examiner can normally be reached on FLEX schedule (generally, Monday-Thursday from 9:00-6:00.) If attempts to reach

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the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached at 703-308-2383. The fax phone number is 703-872-9306.

Mark Ruthkosky

Primary Patent Examiner

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Mark Ruthkosky
9/11/04